2. (Amended) The method of claim 1 further comprising the step of determining the presence of asphaltene aggregates by irradiating said petroleum oils and mixtures of petroleum oils and/or refinery process streams with neutrons and determining small angle neutron scattering (SANS) intensity, I, as a function of wavenumber, q, wherein said scattering intensity includes a coherent component and an incoherent component.

3. (Amended) The method of claim 2 wherein said neutron scattering wavenumber, q, is in the range 10^{-4} Å^{-1} $\leq q \leq$ 1 Å^{-1}.

4. (Amended) The method of claim 3 wherein the compatibility and incompatibility of petroleum oils and mixtures of petroleum oils and/or refinery process streams are determined by fitting $I(q)$ to an equation based on a physical model that contains coherent components, a strongly decaying component to describe the surface scattering of asphaltene aggregates at the q near the lower range (low-q), a plateau component with a rolloff for q near its upper range (high-q) to describe the asphaltene particles, and a constant to describe the q incoherent component.

5. (Amended) The method of claim 4 wherein said equation is given by

$$I(q) = I_{\text{incoh}} + I_{\text{L}} / \left(1 + q^2 \xi^2\right) + I_{\text{surf}} \left(q / q_1\right)^{-\alpha},$$

wherein, I_{incoh} is the constant high-q incoherent scattered neutron intensity, I_{L} is the low-q plateau intensity of the Lorentzian (second term), ξ is the correlation length (proportional to the radius of gyration of an asphaltene particle), I_{surf} is the low-q value of the intensity due to surface scattering from asphaltene aggregates, α is the absolute value of the logarithmic slope of $I(q)$ at low q, and q_1 is fixed by the lowest q in the range.

6. (Amended) The method of claim 5 wherein incompatibility is determined by the concavity of the low-q plateau intensity of the asphaltene particles, I_L, as a function of the volume fraction of mixing, ϕ_m.

7. (Amended) The method of claim 5 wherein incompatibility is determined by the systematic deviation of I_L, as a function of mixing volume fraction from a hard sphere prediction.

8. (Amended) The method of claim 5 wherein incompatibility is determined by a maximum in the correlation length, ξ.

9. (Amended) The method of claim 5 wherein incompatibility is determined by the dominance of the low-q value of the surface scattering intensity, I_{surf}, over the sum of the low-q plateau intensity of the asphaltene particles, I_L, and the incoherent scattering intensity, I_{incoh}.

10. (Amended) The method of claim 5 wherein incompatibility is determined by the power law exponent, α, exceeding a value of three.

11. (Amended) A method to estimate the volume fraction of asphaltene aggregates, ϕ_{agg}, in incompatible petroleum oil and/or refinery process stream mixtures from a difference between I_L, the low-q plateau intensity corresponding to the asphaltene particles, and I_{HS}, the intensity for perfect hard spheres in the absence of aggregation, wherein I_L, and I_{HS} are determined at different volume fractions of mixing, ϕ_m.

12. (Amended The method of claim 11 wherein the equation to estimate the volume fraction of asphaltene aggregates, ϕ_{agg}, is given by the difference between the measured valve of I_L (ϕ_m) and the I_L (ϕ_m) for perfect hard spheres in the absence of aggregation.

A1 13. (Amended) The method of claim 5 wherein the total surface area of asphaltene aggregates per unit volume of the petroleum oil, S_V, is determined from the surface scattering intensity, I_{surf}, at low wavenumbers, q.

14. (Amended) The method of claims 12 and 13 wherein the average length scale, R, associated with the internal structures of the asphaltene aggregates is determined from the ratio of the volume fraction of asphaltene aggregates and the total surface area of asphaltene aggregates.

Please add the following new claim:

A2 15. The method of claim 2 wherein said neutron scattering wavenumber, q, is in the range 10^{-3} Å^{-1} $\leq q \leq 10^{-1}$ Å^{-1}.